

**MAHATMA GANDHI KASHI VIDYAPITH
VARANASI**



**BACHELOR OF SCIENCE
IN STATISTICS**

**Syllabus
(B.Sc. Part I, II and III)
(With Effect from Session 2009-10)**

Department of Statistics
Faculty of science and Technology
Mahatma Gandhi Kashi Vidyapith, Varanasi

Syllabus

B. A. / B. Sc. (Statistics) Part-I

There shall be two theory papers of three hours duration each carrying 75 marks and one practical carrying 50 marks. Candidate shall have to pass in theory and practical papers separately.

Paper-I

Statistical Methods

M. M.: 75

Unit-I

General nature and scope of Statistical methods, collection, compilation and tabulation of Statistical data, diagrammatical representation, frequency distribution and principles governing their formulation, representation by graphs.

Unit-II

Measure of Location and dispersion, moments, Sheppard's (without proof) for moments up to fourth order, measure of skewness and kurtosis.

Unit-III

Bivariate data, scatter diagram, correlation and regression, correlation ratio, intraclass correlation, rank correlation, partial and multiple correlation coefficient in the case of three variables, curves fitting by least square principle.

Unit-IV

Theory of attributes, consistency of data, independence of attributes, association and measures thereof.

Books for References:

- | | |
|---------------------------|---|
| 1. Yale & Kendall | Introduction to theory of Statistics |
| 2. Kapur & Saxena | Mathematical Statistics |
| 3. Goon, Gupta & Dasgupta | Fundamentals of Statistics, Vol-I |
| 4. Gupta & Kapoor | Fundamentals of Mathematical Statistics |

Syllabus

B. A. / B. Sc. (Statistics) Part-I

Paper-II
75

Probability & Statistical Inference

M. M.:

Unit-I

Mathematical and Statistical definition of Probability, Axiomatic approach to probability for the discrete case only, Theorems of Total and compound probability, conditional probability, Baye's theorem, independence of events in probability for two and three events.

Discrete and continuous random variable, probability functions and probability density functions, Distribution Function, Two dimensional random variables, marginal and conditional distribution.

Unit-II

Mathematical expectation, theorems for the expectation of the sum and products of the independent random variables, conditional expectation. Moment generating function and its properties.

Study of some standard distribution-Binomial, Poisson, Hypergeometric, Negative Binomial, Rectangular, Normal, Beta and Gamma Distributions.

Unit-III

Theory of point estimation, Criteria of a good estimator: unbiasedness, consistency, efficiency and Sufficiency (definition), Maximum likelihood estimators and statement of its properties.

Elements of testing of hypothesis, simple and composite hypothesis, two kinds of errors, power, size, test of significance, Level of Significance.

Unit-IV

Definition of χ^2 , t and F distributions and their main characteristics (without proof). Test based on Normal, χ^2 , t and F distributions and Z-transformation and its applications.

Books for References:

1. Mood, A. M., Boes, D. C. and Graybill, F. A. Introduction to the theory of Statistics
2. Goon, Gupta & Dasgupta Fundamentals of Statistics, Vol-I
3. Srivastava, S. R. Elements of Probability and Statistics
4. Lindgren Statistical Theory
5. M. Mukhopadhyay Statistics & Probability

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Syllabus

B. A. / B. Sc. (Statistics) Part-II

There shall be two theory papers of three hours duration each carrying 75 marks and one practical carrying 50 marks. Candidate shall have to pass in theory and practical papers separately.

**Paper-I Official, Economics, Vital Statistics & Statistical Quality Control M. M.:
75**

Unit-I

Nature and scope of Statistical inquiries, framing of questionnaire, Indian official statistics relating to agriculture, trade, labour, national income and census.

Elementary theory of index numbers, constructions and uses of price index number, cost of living index numbers. Important index number series currently used in India.

Unit-II

Analysis of time series and concepts of different components, determination of trend and seasonal indices by different methods.

Unit-III

Element of vital statistics, method of organization of collection of vital statistics in India, Measurements of mortality, standardization of death rates, general description of a complete life table, measurements of fertility and reproduction, logistic curve for population growth and its fitting by three selected points.

Unit-IV

Advantages of statistical quality control, construction, use and interpretation of control charts for mean, range, fraction defective and number of defects, single and double sampling, inspection plans, concept of producer's risk and consumer's risk, O. C. and A. S. N. curves.

Books for References:

- | | |
|---------------------------------------|------------------------------------|
| 1. Asthana, B. D. & Srivastava, S. S. | Applied Statistics in India |
| 2. Croxton, F. E. & Cowden, D. F. | Applied General Statistics |
| 3. Goon, Gupta & Dasgupta | Fundamentals of Statistics, Vol-II |
| 4. Gupta & Kapoor | Fundamentals of Applied Statistics |

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Syllabus

B. A. / B. Sc. (Statistics) Part-II

Paper-II

Sampling Theory and Design of Experiment

M. M.: 75

Unit-I

Complete enumeration vs sampling, requirements of a good sample, simple random sampling, stratified random sampling, proportional and optimum allocation, gain due to stratification.

Unit-II

Systematic sampling, Cluster sampling for equal size, Two stage sampling with equal first and second stage units, Ratio, Product and regression method of estimation (All pertaining to SRS)

Unit-III

Basic principles of design: randomization, replication and local control, completely randomized, randomized block and latin square designs, factorial experiments and their advantages, main and interaction effect in 2^2 and 2^3 factorial experiments.

Unit-IV

Analysis of variance applied to the above designs, analysis of covariance in one way classified data.

Books for References:

1. Cochran, W. J. Sampling Techniques
2. Sukhatme, P. V. & Sukhatme, B. V. Sampling theory of Surveys with applications
3. Murthy, M. N. Sampling Theory and Method
4. Kempthorn, O. Design and Analysis of Experiments
5. Cochran, W. G. & Cox, G. N. Experimental Design
6. Fisher, R. A. Design of Experiments
7. Federer, W. T. Experimental Design, Theory & Application

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Syllabus

B. A. / B. Sc. (Statistics) Part-III

There shall be four theory papers. Each theory paper shall carry 60 marks and will be of three hours duration. There shall be two practical examinations of three hours duration carrying 30 marks each. To pass in theory as well as practical papers is compulsory.

Paper-I
60

Statistical Inference

M. M.:

Unit-I

Theory of estimation, minimum variance property, Cramer-Rao inequality, sufficiency, factorization theorem (without proof), Rao-Blackwell theorem, complete sufficient statistics, Lehman-sheffe theorem.

Unit-II

Methods of estimation: maximum likelihood estimates and their properties, B. A. N. estimate, method of moment, minimum chi-square and method of least squares, point estimates of parameters of Poisson, Normal, Uniform and Exponential distribution. Theory of confidence intervals, simple problems of setting confidence limits.

Unit-III

Theory of testing of hypothesis, randomized and non-randomized tests, Neyman Pearson fundamental lemma, locally and uniformly most powerfull test, unbiased test, use of compete and sufficient statistics in construction of the tests, likelihood ratio test (LRT) criteria (statement) and its application to Norman population.

Unit-IV

Non parametric test: One sample problems: Run test, Kolmogrow-Smirnov test, sign test, Wilcoxon signed rank test.

Two sample problems: Word-Wolfowitz run test, Kolmogrow-Smirnov test, median test, Wilcoxon test, Mean Whitney U-test.

Books for References:

1. Mood, A. M., Boes, D. C. and Graybill, F. A. Introduction to the theory of Statistics
2. Kendall, M. G. & Stuart, A. Advanced Theory of Statistics Vol.-II
3. Hogg, R. V. & Graig, A. T. Introduction to mathematical statistics
4. Goon, A. M., Gupta, M. K. & Dasgupta, B. An Outline of Statistics, Vol.-I
5. Rohatgi, V. K. Introduction to Probability and Statistics

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Syllabus

B. A. / B. Sc. (Statistics) Part-III

Unit-I

Sample space, probabilities in discrete space, occupancy and ordering problems, combination of events, conditional probability.

Unit-II

Generating functions, characteristic functions, compound Binomial and Poisson distributions. Elementary ideas of convergence in probability, Tschebysheff's inequality, weak law of large numbers, central limit theorem (statement) and its applications.

Unit-III

Distribution of functions of random variable, concept of sampling distribution and standard error, distribution of linear functions of independent normal variables, derivation of sampling distribution of χ^2 , t, F and z, derivation of sampling distribution of mean and variance from Normal distribution, sampling distribution of correlation coefficient from uncorrelated bivariate normal distribution.

Unit-IV

Order statistics, derivation of distribution of functions of order statistics (minimum, maximum, range, median), Elementary idea of non-central distributions.

Books for References:

- | | |
|-------------------------------|---|
| 1. Feller | Probability theory and its Application, Vol.-I |
| 2. Hogg, R. V. & Graig, A. T. | Introduction to mathematical statistics |
| 3. Carmer, H. | Mathematical Methods of Statistics |
| 4. Rao, C. R. | Linear Statistical Inference and its Applications |

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Syllabus

B. A. / B. Sc. (Statistics) Part-III

Unit-I

Finite Differences and E operators, Difference of zero, interpolation, interpolation formula due to Newton, Lagranges, Bessel, Stirling.

Unit-II

Inverse interpolation, summation of series, numerical differentiation and integration.

Unit-III

Numerical solutions of algebraic and transcendental equations, simultaneous linear equations, difference equations: (Homogeneous linear difference equations only)

Unit-IV

Numerical solution of differential equations, Euler method, Modified Euler method, Picard method, Taylor series method and Runge Kutta method.

Books for References:

- | | |
|-----------------------|---------------------------------|
| 1. Saxena, H. C. | Calculus of finite differences |
| 2. Scarborough, J. B. | Numerical Mathematical Analysis |
| 3. Atkinson | Elementary Numerical Analysis |

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Syllabus

B. A. / B. Sc. (Statistics) Part-III

**Paper-IV
60**

Operation Research

M. M.:

Unit-I

Definition and scope of operation research, different types of models in operation research, their construction and general methods of solution. Elements of linear programming.

Unit-II

Graphical method of solving L. P. P., simplex procedure, Artificial basis technique, principle of duality and duality theorem, Allocation models-Transportation (feasible solution) and Assignment.

Unit-III

Theory of Games, zero sum two person games, saddle point, optional strategies, maxmin minmax principle for rectangular games, games without saddle points, graphical solution of $2 \times N$ and $M \times 2$ games, solution of matrix games by dominance principles, reduction of game problem to a linear programming problem.

Unit-IV

Elements of queueing theory, different type of queueing models M/M/1 system (finite and infinite) and M/M/K systems.

Replacement Models: capital equipment items that fail and of items that deteriorate with time. Elementary inventory models.

Books for References:

1. Gass, S. L. Linear Programming Methods and Applications
2. Sasient, M., Yaspan, A. & Friedman, L. Operation Research Methods and Problem
3. Kothari, S. D. Operation Research
4. Swarup, K., Gupta, P. K. & M. Mohan Operation Research
5. Sharma, S. D. Operation Research

Practical

Practical will based on theory papers. One set of two theory papers will constitute one practical and other set of two theory papers will constitute other practical.